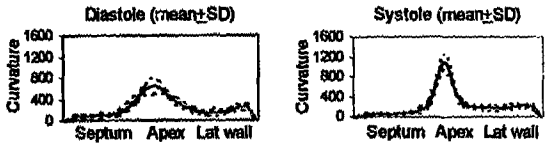

End diastolic shape is characterized by low curvature values suggesting a more globular outline. During cardiac contraction, there is a general increase in curvature but this is particularly prominent at the apex. Curvature values are highly reproducible (accuracy: ± 6.5%, precision: ± 6.5%). This technique which is devoid of idealized geometric shape and reference systems may provide a useful method for quantifying serial shape changes that occur during pathophysiologic adaptation.

930-113 Detection of Microvascular Stunning After a Brief Myocardial Ischemia Using Myocardial Contrast Echocardiography in Dogs

Tomohiro Kondo, Makoto Onishi, Yukihisa Kitagaki, Tadaaki Iwasaki. *Hyogo College of Medicine, Nishinomiya, Japan*

We tried to detect microvascular stunning (MVS) after a brief myocardial ischemia using myocardial contrast echocardiography (MCE) and evaluated the influence of MVS on myocardial stunning in dogs. Methods: In 7 open-chest dogs with a bypass between carotid artery and left anterior descending coronary artery (group 1), the bypass was subtotal-occluded for 30 min and then released. The MCE was repeatedly performed before occlusion and immediately, 2, 4, 6, 8 and 10 min after release. We measured the background-subtracted peak intensity (ΔPI) and the washout rate (WR: ΔPI divided by washout time) of anterior region at each stage. Regional wall motion abnormality of the anterior region was analyzed by centerline method and expressed as the summation of standard deviation (ΣSD) from the mean wall motion of 20 normal dogs. In other 4 dogs (group 2), the intravenous infusion of diltiazem was started before occlusion and the same measurements were done. Results: 1) In group 1, reactive hyperemia continued until 4 min after release, and both ΔPI immediately and at 4 min after release were significantly higher than that before occlusion (ΔPI: 51 ± 3 and 46 ± 4 vs. 40 ± 4, $p < 0.05$). However, the WR immediately after release was significantly lower than that at 4 min (WR:1.5 ± 0.6 vs. 2.6 ± 0.7, $p < 0.05$). Regional wall motion abnormality still remained at 4 min after release (ΣSD: before occlusion vs. at 4 min; 10 ± 3 vs. −18 ± 6, $p < 0.05$). 2) In group 2, ΔPI immediately after release was significantly higher than that before occlusion. However, myocardial contrast enhancement rapidly disappeared and there was no significant difference of the WR between immediately after release and before occlusion (WR: 3.0 ± 0.5 vs. 2.9 ± 0.3, ns). Regional wall motion had already recovered at 4 min after release (ΣSD: before occlusion vs. at 4 min; 12 ± 5 vs. 14 ± 14, ns). *Conclusion:* MVS may be caused by calcium overload in the smooth muscle of the coronary resistance vessels and may play a role on myocardial stunning. The MCE is a useful tool to visualize the change of microvascular dysfunction with time.

930-114 Color Doppler Energy Reduces Attenuation Effects and Produces More Consistent Images of Cardiac Shunts and Lesions

Albert C. Lardo, Cheryl L. Reid, Julius M. Gardin, Toru Ogata, Keong Joung, Edward G. Cape. *Cardiac Dynamics Laboratory, Children's Hospital, University of Pittsburgh, PA; University of California Irvine, CA*

Despite its basic definition as a matrix of velocities, Color Doppler Flow Mapping (CDFM) has been most useful for detecting the *presence* and *spatial extent* of flow. In growing children and adults with pulmonary disease or progressive weight increase, images from exam to exam can be affected by variable attenuation of the ultrasound. Color Doppler Energy (CDE) is an alternative method which displays integrated signals and should be less affected by attenuation. This study examined this concept in a flow phantom using *controlled degrees of attenuation. Methods:* Jets with orifice velocities ranging from 1–5 m/s were generated and imaged using CDFM and CDE. CDFM and CDE images were planimetered and compared at four degrees of attenuation. Physiologic degrees of ultrasound tissue attenuation were simulated using multiple layers of a reticulated absorbing foam (Crest Foams Ind. Inc., Moonachie, NJ). *Results:* Attenuation had a significant effect on jet area for each imaging modality ($p < 0.0001$). CDE jets, however, showed significantly less attenuation than CDFM jets for all conditions studied ($p < 0.0001$). This effect was more pronounced at lower flows ($p < 0.0001$). *Conclusions:* CDE imaging reduces variability associated with tissue attenuation and provides a more direct measure of flows of interest than CDFM. This modality has application in logitudinal studies of patients with chronic valvular regurgitation and will be especially useful for distinguishing between mild and moderate cases.

930-115 New Sign of Regional Early Diastolic Dysfunction Assessed by Tissue Doppler Echocardiography (TDE)

Christian Bruch, Axel Schmermund, Christiane Plato, Raimund Erbel. *Department of Cardiology, University Hospital Essen, FRG*

In the current study 21 normal subjects (mean age 46 ± 14) and 9 patients with coronary artery disease (CAD; seven with luminal narrowing of the LAD > 70%, two with anterior myocardial infarct, mean age 56 ± 14) were examined by M-Mode- and 2-D-TDE analyzing the midseptal and midlateral segments of the left ventricle in the apical 4-chamber-view. In early diastole (i.e. isovolumic relaxation time, IVRT) normals showed synchronous outward movement of the septum (−1.40 cm/s ± 0.88) and the free wall (−1.78 cm/s ± 0.93) with low tissue velocities, which was followed by a rapid symmetrical outward motion (septum −7.79 cm/s ± 1.53; free wall −8.93 cm/s ± 1.85) after the opening of the mitral valve (i.e. rapid filling phase). In 8 of 9 CAD patients TDE demonstrated an abnormal inward movement of the septum with low positive tissue velocities (+1.81 cm/s ± 1.74) during IVRT while the contralateral free wall was moving outwards (−1.73 cm/s ± 1.02). In rapid filling phase high negative velocities were found in both the septum (−5.48 cm/s ± 2.76) and the free wall (−5.38 cm/s ± 1.90) as it is shown in table 1 (ns = not significant):

Disease	ASE-segment	SYST.max (cm/s)	IVRT.max (cm/s)	RF.max (cm/s)
Normals (n = 21)	midseptal	5.45 ± 1.07	−1.40 ± 0.88	−7.79 ± 1.53
	midlateral	5.69 ± 1.57	−1.78 ± 0.93	−8.93 ± 1.85
CAD (n = 9)	midseptal	4.53 ± 1.63 ns	+1.81 ± 1.74 $p < 0.001$	−5.48 ± 2.76 $p < 0.05$
	midlateral	5.05 ± 1.43 ns	−1.73 ± 1.02 ns	−5.38 ± 1.90 $p < 0.01$

Conclusion: TDE is able to show regional diastolic dysfunction during IVRT in CAD patients demonstrating a significant ($p < 0.001$) abnormal inward motion of the affected ventricular segments.

931 Contrast Echocardiography: Methodology

Monday, March 25, 1996, 3:00 p.m.–5:00 p.m.
Orange County Convention Center, Hall E
Presentation Hour: 3:00 p.m.–4:00 p.m.

931-116 Myocardial Opacification by Low Doses EchoGen in Patients: Assessment of Preactivation by Closed Syringe Suction

Bruno Cotter, Anh Duong, Ajit Raisinghani, Shahin Keramati, Ehtisham Mahmud, Oi Ling Kwan, Karen Wheeler, Anthony N. DeMaria. *University of California at San Diego, San Diego, CA*

EchoGen(EG) is a new ultrasonic contrast agent which undergoes a liquid-to-gas phase shift at body temperature. EG at doses of 0.5 to 0.7 cc/kg has consistently produced myocardial opacification following IV injection. This study assessed the ability of a simple hydrodynamic preactivation maneuver to achieve myocardial enhancement with low dose EG. We performed parasternal short axis imaging in 14 pts undergoing echocardiography for clinical indications. After withdrawing the EG, preactivation consisting of transient (1–2 second) negative pressure was produced by withdrawing the plunger and creating suction in the closed syringe system. Incremental EG doses were given into the brachial vein: 0.02 cc/Kg (2 pts), 0.045 cc/kg (10 pts) and 0.07 cc/kg (2 pts). Echo, EKG, O2 sat, BP, and HR were obtained at baseline and monitored for 1 hr post injection. CBC, coagulation studies, and 15 chemistries were obtained prior to and 1 and 24 hrs post injection.

Videodensitometry was obtained from a 0.5 cm^2 ROI placed in the mid septum (region of maximal enhancement). Hydrodynamically activated low doses of EG produced visually apparent myocardial opacification in 10 pts (4+, 5++, 1+++). Videodensitometry increased from 22 ± 4 to 39 ± 12 (mean ± SD) gray levels ($p = 0.001$) at peak intensity. Myocardial opacification was maximal at 15–20 seconds and persisted for 54 ± 31 sec (mean ± SD). There were no significant changes in EKG, 02 Sat, BP, HR and blood analytes after the injection. Two pts had adverse events: facial flushing, modification of taste and cutaneous rash that were mild and transient. Thus, hydrodynamic preactivation by simple brief closed syringe suction enables myocardial opacification to be achieved with injection of low dose EchoGen. This approach should be of value in applying EG to assess myocardial perfusion in clinical pts.

MONDAY POSTER